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ABSTRACT

This longitudinal study focused on predicting student outcomes through multiple test scores and vocational preferences using standardized instruments and self-reports of career plans. A total of 444 students in the class of 1986 were enrolled in either a non-vocational or vocational curriculum at one of 4 high schools in a small, rural, working-class school district during the 4 academic years between 1982-83 and 1985-86 and completed from 1 to 4 standardized tests as part of the district's comprehensive testing program. Three hundred and fourteen of these students actually graduated in 1986; these graduates were all administered the Differential Aptitude Test, Ohio Vocational Interest Survey, California Achievement Test, and Stanford Achievement Test; and they were mailed a follow-up questionnaire. Using the stepwise method of discriminant analysis to predict group membership, classification efficiency ranged from 61% to 74%, indicating that a significant portion of the class might have benefited from an alternative curriculum. Career choice and actual plans were more likely influenced by socioeconomic status, rural location, and expressed vocational preference than by actual test scores. Results suggest that some of the non-vocational students might have been more successful in a vocational curriculum. School counselors must help students achieve more congruence between test scores, expressed vocational choice, and their mitigating environmental circumstances. Four data tables and a 23-item list of references are included. (Author/TJH)

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Longitudinal Study Using a Standardized Test Battery as Predictors of Student Outcomes in a Rural County School System

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Paper presented at the annual meeting of the Eastern Educational Research Association, Clearwater Beach, Florida

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Running Head: DISCRIMINANT ANALYSIS

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Abstract

This longitudinal study focused on predicting student outcomes through multiple test scores and vocational preferences using standardized instruments and self-reports of career plans. Vocational and nonvocational graduates of a small, rural, working class school system were administered the Differential Aptitude Test, Ohio Vocational Interest Survey, California Achievement Test, and Stanford Achievement Test and mailed a follow-up questionnaire. Using the stepwise method of discriminant analysis to predict group membership, a classification efficiency ranged from 61% to 74% indicating that a significant portion of the class may have benefited from an alternative curriculum. Career choice and actual plans were more likely influenced by socioeconomic status, rural location, and expressed vocational preference than actual test scores. Results suggested that some of the nonvocational students might have been encouraged to choose and been more successful in a vocational curriculum. School counselors must help students achieve more congruency between test scores, expressed vocational choice, and their mitigating environmental circumstances.

LONGITUDINAL STUDY USING A STANDARDIZED TEST BATTERY AS PREDICTORS OF STUDENT OUTCOMES IN A RURAL COUNTY SCHOOL SYSTEM

Introduction

As our post-industrial nation moves into the twenty-first century, it becomes critical that we prepare today's youth for the social and economic challenges ahead. Secondary school systems are key operatives in the process that enables youth to bridge the gap between high school, college, and/or career. Since high schools have impact on this developmental process, guidance counselors must have the means and indicators to guide each student toward the most personally and academically appropriate career path. Standardized aptitude tests, achievement tests, and interest inventories, as well as individual and social dispositions and expectations, have traditionally been the vehicles for career exploration available to school guidance counselors. However, adapting students' test results to stated interests will be effective only if used appropriately.

Theoretical Framework

Standardized assessment instruments such as achievement, aptitude, and interest batteries have been used most frequently in school guidance programs to assist counselors and students in career planning and decision making processes. In addition to

these, the major predictors of success after high school include a combination of career goals and plans, background characteristics (such as socioeconomic status, school size, location), and personal characteristics (such as sex, race) (Prediger, 1980; Prediger & Sawyer, 1986; Quatrano, 1976; Sanford, 1977; Willingham, 1985).

Interest, achievement, and aptitude instruments, as related to education and occupational curricula, have been examined in various ways in previous studies. Hackstein and Woolsey (1985) related criterion-referenced comprehensive ability tests to measure achievement for diagnostic purposes in counseling situations. With the added impact of longitudinal comparison, Ansley and Forsyth (1983) and Loyd, Forsyth, and Hoover (1981) used elementary and secondary standardized achievement test scores to predict college success as measured by grade point average. Malloch and Michael (1981) found aptitude test scores particularly helpful at predicting academic performance as measured by grade point average at community colleges.

Despite the importance placed on test batteries and individual performance, the decline in standardized test scores sparked the examination of alternative explanations for the decline. According to Touron (1983), the best predictors of academic achievement appeared to be secondary school results, knowledge and intellectual capacity, results from the Differential Aptitude Test, stated vocational preference, and

overall academic achievement. Weaver (1986) stated that the level of family income and parents' degree and educational achievement were significantly better predictors of job success and lifetime income than test scores alone. Pepin and Karb (1979) predicted postsecondary activity from scores on the Differential Aptitude and the Scholastic Aptitude Tests, along with students' sex, race, socio-economic status, and grade point average in high school. Similarly, Beckman (1977) learned that high school academic achievement, coupled with rural background, low socio-economic status, uncertain attitudes about the future, and the lure of immediate income, affected outcomes for students beyond high school. Finally, the longitudinal study of Darakjian and Michael (1983) showed that predictive values of math achievement test scores combined with academic self-concept and level of aspirations forecasted success.

With increasing emphasis being placed on preparing students for vocational pursuits, the addition of interest inventories to school testing programs became necessary (Quatrano, 1976). Expressed vocational choice rather than measured interest also appeared to be the better predictor; however, persistence in a career path increased where expressed and measured vocational choices were congruent (Laing, Swaney, & Prediger, 1984; Wiggins & Westlander, 1977). When Noeth and Jepsen (1980) correlated expressed vocational choice with actual jobs, they learned that the time between choice and role assumption influenced choice,

and that early implementation of choice hovered chiefly around the unskilled and semiskilled positions.

Purpose of the Study

Earlier studies support the notion that predicting student outcomes in career and academic success stem from multiple test scores, environmental factors, and vocational preferences. Therefore, the present study addresses two goals: (1) To determine the predictive value of several standardized tests for determining high school vocational and nonvocational curricula; and (2) To identify students' current and future educational and career plans, using standardized instruments and self-reports;

As part of a comprehensive statewide testing program, the study results will interest state legislators, taxpayers, parents, and school counselors and administrators. If results from one district prove valuable, the analytical procedures theoretically could be applied to statewide samples in order to develop local and statewide norms, district comparisons, and to facilitate curricular changes.

Methodology

Study Location

The study focuses on students in a small, rural county in southeastern United Stated with a population of 40,000, of which 36% of the residents are black. The economic industrial base revolves around a large textile manufacturing mill, where the white population traditionally assumes clerical, sales, and

machine trade positions, and the majority of the black population secures employment in lower-income service, machine trades, and benchwork occupations. The county supports a community college branch with a large land-grant university and a liberal arts college in neighboring counties. Within a fifty mile radius are three military installations.

The county public school system consists of four high schools; three are relatively small, rural, and of lower socio-economic class, and the fourth is distinctly larger and situated near the working-class industrial center. Within this county, many more white students choose to enroll in private academies or Christian secondary schools rather than attend the public schools. Median school years completed by persons under 25 years of age living in the county are 9.8.

Study Population

Four hundred forty-four individuals attended one of the district high schools during the four academic years between 1982-83 and 1985-86 and students completed from one to four standardized tests as part of the district's comprehensive testing program. Students enrolled in either a nonvocational or vocational curriculum. Three hundred-fourteen of the subjects graduated from one of the high schools in 1986.

Hypotheses

Based on the test information available, lower test scores for the achievement and aptitude tests are expected for this

population as compared with national norms. Interest inventory results would more likely reflect working class occupations. Accounting for the rural, southern culture and family-based traditions, we predict that student test results would most likely reflect associate level and technical preparation rather than baccalaureate and advanced degree pursuits. Due to the high number of nonvocational enrollees, we suspect the possibility of the incorrect placement of a significant number of students. Therefore, we predict that most of the nonvocational students would receive two-year rather than four-year degrees and that vocational graduates would pursue occupations available in the local labor market or join a branch of the armed services.

Instrumentation

Standardized aptitude, interest, and achievement instruments were used in the study. Test scores were not available from the entire population since students entered and left the district during the four secondary school years. During their ninth grade, students were administered the Differential Aptitude Test (DAT, Form W; Bennett, Seashore, & Wesman, 1982) (n=158) and the Ohio Vocational Interest Survey (OVIS, D'Costa, Odgers, & Koons, 1969). Seven scales are contained in the DAT: verbal reasoning (VR), numerical ability (NA), language usage (LU), spelling (SPELL), mechanical reasoning (MR), spatial relations (SR), abstract reasoning (AR), and clerical speed and accuracy (CSA).

The California Achievement Test (CAT, Form C, Level 19, Tiegs & Clark, 1977), administered in tenth grade (n=104), contained the following ten scales: language (L), nonlanguage (NL), reading vocabulary (RV), reading comprehension (RC), spelling (S), language mechanics (LM), language expression (LE), reference skills (RS), mathematics computation (MC), and mathematical concepts (MC). During the students' eleventh grade (n=172), five scales of the Stanford Achievement Test (SAT, Madden, Gardner, Rudman, Karlsen, & Merwin, 1975) were administered: reading comprehension (C), reading vocabulary (V), spelling (SP), English (E), and mathematics (M).

Cronbach alpha reliability coefficients for the DAT, CAT, and SAT for the samples investigated ranged from .94 to .98. Published reliability coefficients ranged from .84 to .98 (Madden, et al. 1975; Tiegs & Clark, 1977; Bennett et al, 1982).

In the spring of 1989, the three hundred-fourteen 1986 graduates were mailed a one page questionnaire designed to identify their occupational and educational status three years after high school graduation. The instrument assessed previous, current, and future educational and career pursuits. After two mailings, eighty-four questionnaires were returned undeliverable while forty-one usable questionnaires were returned. Low response rate was attributed to unavailable or incomplete addresses, incomplete school records, the possible failure of some graduates to comprehend the questions, a desire by others

not to reveal negative career or personal outcomes, and the population's overall lack of interest in the goals of the present study---potential hazards inherent in a longitudinal study.

Procedure

Discriminant analysis was chosen because of its ability to predict group membership based on the characteristics of different variables, such as test scales or combinations of test scales (Klecka, 1980). The stepwise discriminant analysis procedure allowed for independent analysis of the different test scales used in the study. Group means for the DAT, CAT, and SAT scales were calculated first and used to compute canonical coefficients that classified group assignment into different discriminant functions (Norusis, 1985).

Discriminant analysis was used to validate group assignment, or classification into vocational/nonvocational groups, and was performed for individual cases. Misclassification errors occurred when discriminant analysis classified individual cases into the group to which they did not belong. To apply the stepwise discriminant analysis procedure efficiently, a separate stratified sample was created to reflect equal membership size in the vocational and nonvocational groups for each of the five analyses. These samples included only those graduates with usable scores from the DAT, CAT, or SAT. The eligible pool of students for selection to the sample was thus reduced

substantially by the stringent requirements of the statistical design.

Verbal (n=188) and math (n=86) scales from the DAT, SAT, and CAT were combined to determine the most significant discriminating scales. Expressed and measured interest results (OVIS) were compared with actual career status for the forty-one follow-up questionnaire respondents, to determine the stability of the earlier measurement of occupational interests.

Results

Discriminant Analysis

Group means and standard deviations were calculated for each scale and are listed in Table 1. Means were subsequently used with the stepwise discriminant method to determine which scales discriminated among vocational and nonvocational graduates.

INSERT TABLE 1 HERE

Discriminant statistics for the three instruments were analyzed with the stepwise discriminant method and results are contained in Table 2. The stepwise method, or independent analysis of each variable, yielded significant results. For the Differential Aptitude Test, numerical ability, language usage, and to a lesser degree, spelling, were the three scales significantly loaded in the discriminant function. However, the more specialized vocational DAT scales (i.e., mechanical and abstract reasoning and clerical speed and accuracy) did not

discriminate among the vocational and nonvocational graduates. On the Stanford Achievement Test, mathematics and reading vocabulary significantly loaded on one discriminant function. The California Achievement Test results showed that only one scale, spelling, significantly loaded into the function that discriminated among nonvocational and vocational graduates. Results for the combined language scales analysis revealed four scales loaded significantly on the discriminant function: English (SAT), language usage and verbal ability (DAT), and spelling (CAT). With math variables, the SAT math variable and DAT numerical ability scales loaded into one function that discriminated between vocational and nonvocational groups.

INSERT TABLE 2 ABOUT HERE

Classification Results

Nonvocational and vocational graduates were classified as either members of the group to which they actually belonged or to which their test scores predicted them to be. Discriminant classification efficiency is a proportional estimate for how well the discriminant statistics predicted group membership for individuals whose membership was already known. Overall discriminant classification efficiency ranged from 61% to 74% for the five analyses conducted.

For the Differential Aptitude Test, 61% of the nonvocational and 70% of the vocational graduates were correctly classified.

Referring to the SAT, 69% of the classification were correctly placed in nonvocational and 80% in the vocational curriculum. For the California Achievement Test, correct classification was 58% for nonvocational graduates and 65% for vocational.

When language scales from all three instruments were analyzed, 69% of the nonvocational and 72% of the vocational graduates were correctly classified. For math scales, 58% nonvocational and 72% vocational graduates were correctly assigned to their actual group. Numerical and proportional results for the two groups are presented in Table 3.

INSERT TABLE 3 ABOUT HERE

Of the forty-one usable questionnaires, seven were tracked as vocational students and thirty-four as college preparatory or general curriculum students. The following responses were drawn from their test results and self-reports and compared for each respondent: curriculum, DAT occupational choice, OVIS occupational choice, and OVIS expressed career preference; career and educational plans; and current job title.

Of the vocational students, two showed a somewhat congruent path between early measured and expressed occupational choice and their actual career path as shown in Table 4. Five remaining respondents showed highly dissimilar career interests as compared with actual pursuits. However, six worked and one attended a junior college.

INSERT TABLE 4 ABOUT HERE

Further illustrated in Table 4, approximately eight of the thirty-four nonvocational students showed a high degree of congruency between their tested interests and their actual career pursuits. Sixteen respondents were categorized as showing similar results on the DAT and the OVIS inventories but pursuing noncongruent career paths. Eight respondents indicated dissimilarities between DAT and OVIS choices but showed similarities between their expressed vocational choice, career plans, and current job title. Two participants showed no similarities between test scores and career pursuits. In fact, eighteen participants in the nonvocational track recorded OVIS and DAT choices in the areas of farming and agriculture, manual work, crafts and trades, machinery and motor vehicles, clerical work, and applied technology.

Looking more closely at the nonvocational group, seventeen attend two-year colleges, twelve attend four year institutions, and four do not attend any institution of higher learning. Twenty-five of the twenty-nine attending college, work full or part time; many had secured jobs at the large textile mill in the county.

Discussion

While the sample used to compared standardized response with self-reports is too small to produce vast generalization, it does

suggest a pattern similar to the discriminant analysis results of all student test scores. It is possible that as many as one-third of the members of the Class of 1986 may have been tracked incorrectly. The data suggest two possible explanations.

First, the disparity in expected aptitude test results may be related to the sample under investigation, such that career goals and plans in this small, rural, working class county are attributed to more than standardized test scores. The data support Pepin and Karb's (1979) and Weaver's (1986) emphasis on socioeconomic status; Beckman's (1977) and Willingham's (1985) significance of the school's rural location; and Laing et al's (1984), Touran's (1983), and Wiggins and Westerlander's (1977) notion of the importance of expressed vocational preference. In this case, tradition seems more likely to dictate school and career outcomes to the students who responded to the questionnaire. Of those attending college, most opt for the two year college due in part to their high school preparation, a desire not to take the ACT in high school or to have done poorly on it, their proximity to a two year school, and their financial situation (as evidenced by large numbers holding jobs while attending college). As suggested by Beckman (1977), the textile mill draws students with the lure of immediate employment and income.

Second, the scores on the DAT, SAT, CAT, and OVIS may not be used as effectively as possible by the counseling staff in this

rural system. Too many respondents in the sample showed an incongruency between test results, curriculum chosen, expressed vocation, and actual career choice. Only eight are relatively similar among nonvocational students and two among vocational students. For example, 39% of the nonvocational students resemble the vocational group based on the test score characteristics of the DAT. The results suggest that some of the nonvocational students might have chosen and been more successful in a vocational curriculum. By contrast, the nursing assistant (although showing congruency between tests and actual responses) may have received better career preparation in the nonvocational curriculum. Furthermore, students with inclinations toward blue and pink collar occupations still remained in a nonvocational track.

Summary

The results of this study of a small, southern, rural county school system indicate that even small samples can provide valuable information and insight into individual, school, and district counseling and planning strategies. The data support the notion that predicting working class student career outcomes is indeed a function of expressed vocational choice and interest, and mitigating environmental circumstances that often take precedence over scores from standardized test batteries. However, more needs to be done to ensure that standardized test results are shared and discussed with students in order to

establish some congruency in facilitating more informed career decisions. Additional information to students might feature a comparison of their scores with previous graduates of the school system or with students from similar environments regionally. More importantly, the study results aid curriculum supervisors in the long range planning processes of revising, eliminating, and adding vocational and nonvocational courses and programs to address the needs of this rural, working class population.

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Table 1

Means and Standard Deviations for DAT, SAT, and CAT

Var	Group	M	SD
DAT	NV	19.35	12.61
VR	V	14.28	7.3
	NV	20.16	9.33
NA	V	15.06	6.35
	NV	21.33	9.84
LU	V	16.57	6.82
	NV	51.71	16.93
SPELL	V	48.15	13.41
SAT	NV	34.94	9.04
C	V	27.43	8.58
	NV	22.49	7.56
V	V	16.16	7.13
	NV	26.13	7.48
SP	V	21.56	6.99
	NV	36.91	9.40
E	V	30.63	9.06
	NV	26.90	10.84
M	V	16.87	7.21

Var	Group	M	SD
CAT	NV	21.92	7.41
L	V	19.42	6.94
	NV	25.04	8.57
NL	V	23.83	10.13
	NV	21.56	7.95
RC	V	20.81	10.97
	NV	14.46	5.88
RV	V	14.25	11.64
	NV	10.42	3.81
S	V	8.75	3.32
	NV	16.44	4.56
LM	V	16.19	11.48
	NV	24.65	6.59
LE	V	23.96	7.83
	NV	17.81	5.25
RS	V	18.35	11.27
	NV	22.00	9.13
MCM	V	20.17	7.52
	NV	23.29	8.81
MCN	V	21.10	9.66

VR = Verbal Reasoning
NA = Numerical Ability
LU = Language Usage
SPELL = Spelling
C = Reading Comp.
V = Reading Vocab
SP = Spelling
E = English
M = Math
L = Language
NL = Nonlanguage
RC = Read. Vocab
RV = Reading Comp.
S = Spelling
LM = Language Mechanics
LE = Language Express.
RS = Reference Skills
MCM = Math Comprehension
MCN = Math Concepts

Table 2

Discriminant Statistics for DAT, SAT, and CAT

Variable	Wilk's lambda	p	A	B	C	Constant
DAT						
NA	.91	.0001***	.080	.90.	.64	-1.72
LU	.89	.0002***	.082	.79	.70	
SPELL	.88	.0003***	-.025	.33	.38	
SAT						
M	.77	.0000***	.086	.97	.29	-2.67
V	.76	.0000***	.040	.77	.80	
CAT						
S	.95	.02*	.28	1.0	1.0	-2.68
Language						
E	.93	.0004***	-.058	-.52	-.94	-.28
LU	.81	.0000***	.023	.52	.68	
VR	.80	.0000***	.070	.44	.27	
S	.80	.0000***	.036	.20	.19	
Math						
M	.83	.001***	.141	.94	1.37	-1.89
NA	.81	.0002***	-.071	.54	-.54	

* $p < .05$ ** $p < .01$ *** $p < .001$

A Unstandardized Canonical Discriminant Function Coefficients

B Pooled Within-Group Correlations between Discriminating Variables and Discriminating Functions

C Standardized Canonical Discriminant Function Coefficients

Table 3

Classification Results for Nonvocational and Vocational Groups

Test	Group	Nonvocational N	Nonvocational %	Vocational N	Vocational %	Classification Efficiency
DAT	NV	48	61	31	39	
(n=158)	V	24	30	55	70	65%
SAT	NV	59	69	27	31	
(n=172)	V	17	20	69	80	74%
CAT	NV	30	58	22	42	
(n=104)	V	18	35	34	65	61%
Language	NV	65	69	29	31	
(n=188)	V	26	28	68	72	71%
Math	NV	25	58	18	42	
(n=86)	V	12	28	31	72	65%

Table 4
Comparisons of the Sample Group

Case	Curriculum	DAT Occupational Choice	OVIS Occupational Choice	OVIS Expressed Choice	Eventual Career Plans	Current Education Plans	Current Job Title
1.	Non-Vocational	Business Sales	Personnel Work		Business Management	Jr. College	Student/Wal-Mart Mgr.
2.	Non-Vocational	Performing Arts	Entertainment Personnel	Entertainment	P.R./ Mass Communications	4 yr. College	Student/Police Dept. Dispatcher
3.	Non-Vocational		Communication	Appraisal; Numerical Wk.	Banking Law	4 yr. College	Student/ Bank Teller
4.	Non-Vocational	Attendant	Medical	Nursing Care Fields Communication	Nursing or Hospital Administration	Jr. College	Student/ Waitress
5.	Non-Vocational	Personal Services	Caring Fields	Medical Nursing	Emergency Medical Tech.	Jr. College	Student/West Point Pepp. Lab Tech.
6.	Non-Vocational	Performing Arts	Artistic	Artistic	Fashion Merchandise	Fashion College	Student/Beauty Advisor
7.	Non-Vocational	Sales Technology	Medical Nursing	Sales Management	Pharmacist	Jr. College	Student/Intech Operator
8.	Non-Vocational	Personal Service		Caring Fields Social Work	Probation Officer	4 yr., College	Student/Cashier
9.	Vocational	Personal Services	Nursing	Nursing Care Fields			Nursing Asst.
10.	Vocational	Sales Display	Skilled Personnel Service	Customer Ser. Skilled Personnel	Secretary Office Mngt.	Jr. College	Student/Cashier McDonald's